Journal of Economic Behavior & Organization 98 (2014) 70–88

Contents lists available at ScienceDirect
Journal of Economic Behavior & Organization
journal homepage: www.elsevier.com/locate/jebo

Developing new ideas: Spin-outs, spinoffs, or internal divisions

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ARTICLE INFO

Article history:
Received 25 November 2012
Received in revised form 18 October 2013
Accepted 6 December 2013
Available online 28 December 2013

Keywords:
Spinoffs
Idea development
Information asymmetry
Employee allocation
Incentives to innovate

ABSTRACT

This paper proposes a theory of how employee-driven innovations are developed. An employee with private information about the value of his idea can create a spin-out, work in a division of the parent firm, or work for a spinoff of the parent firm. Developing an idea in a spinoff allows the parent firm to offer a performance-based contract, which mitigates the adverse selection problem but also decreases the firm's incentives to invest in the project. Therefore, inefficient spin-outs are driven by the informational asymmetry and the endogenous investment of the parent firm. The characteristics of the innovation, the employee's managerial talent, and the firm's performance in its core activity affect the likelihood a spin-out is created. The implementation of employees' ideas in turn affects the innovation process. Ideas with a lower probability of being good are more likely to be explored by an employee within the firm than by an outsider.

1. Introduction

Generating and developing new ideas are important drivers of economic growth. New ideas can emerge in different ways, but many are created by employees within existing firms. The aim of this paper is to propose a theory of how these ideas are developed and analyze how the development decision is related to the characteristics of the industry, of the parent firm, and of the innovation. The modalities of new idea's development affect the agents' incentives to innovate. The paper analyzes these incentives and characterizes the different profiles of innovation initiated within and outside existing corporations.

An employee with an idea can leave the firm and develop the idea in a new independent venture (spin-out). The evidence suggests that many of the new ideas implemented in new ventures were generated while the employee worked for a parent firm in the same industry. Bhide (1994) highlights that *'71% of all founders had replicated or modified an idea encountered through previous employment'*.[1] Gompers et al. (2005) find that 45% of all venture capital-backed startups are spawned by public companies. However, a considerable part of innovative activity occurs within corporations. The parent firm's involvement in developing the ideas may take different forms,[2] some of the ideas are developed internally while others are spun off and implemented in firm's subsidiaries.[3] This raises the following questions: What determines if an idea will be

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[1] The sample: 100 founders of the 1989 Inc 500 fastest-growing private companies.
[2] An example of such involvement are the corporate venturing programs. Those programs finance external or internal projects. In the latter case, the program's aim was to allow the employees to develop their innovations while relying on the company for financial, legal and marketing support.
[3] In the finance literature, a spinoff is created when a public company distributes its equity ownership in a subsidiary to its shareholders, the parent shareholders receive a subsidiary stock in proportion to their ownership in the parent firm. In the model, the term spinoff is used in a broader sense.

0167-2681
http://dx.doi.org/10.1016/j.jebo.2013.12.001

implemented internally or in a spinoff? Is the possibility for the firm to create subsidiaries enough to prevent inefficient spin-out creations? Understanding the path of idea development within firms allows us to understand what differentiates it from the possibilities offered to innovations initiated outside the firm. This raises a new question, what are the differences in the portfolios of innovative ideas explored within and outside the firm?

To address these questions, I proceed in two steps. First, I analyze the stage of idea implementation of employee-driven innovations related to the parent firm's capability. Second, I compare the incentives to innovate for agents within and outside the firm and discuss differences in patterns of innovation.

Employees come up with innovative ideas: a new technology, a new production process, or a new product. Since the analysis is about employee-driven innovations, I assume (i) that the employee has better knowledge than anybody else about the value of his innovation and (ii) that he is critical for the implementation of the idea. For each employee, the parent employer decides whether to keep him or not, and if the employee is retained whether to let him develop his idea (in a division or in a spinoff) or allocate him to the firm's core activity. In the latter case, the project is not implemented. The parent firm can contribute to the performance of the new idea by allocating resources to it. The allocation of resources to a new idea has an opportunity cost, and the amount to be allocated depends on the corporation's share in the new idea.

If the idea is developed in a division of the firm, then the idea's performance cannot be disentangled from the overall performance of the corporation. The employer can offer only a fixed wage contract to an employee. In this case, the firm is a residual claimant of the idea's profits and therefore has strong incentives to invest in the new activity. The downside is that since the employee's reward is not based on performance, the information asymmetry problem is very strong. Indeed, to prevent an employee with a bad idea from pretending he has a good one, the employer must offer him the same reward as to an employee with a good idea.

Alternatively, the parent firm may allow an employee with a good idea to develop it in a spinoff (subsidiary of the firm). In this case, the firm can offer a performance-based contract to mitigate the information asymmetry problem. However, giving up a share of the cash flows to the employee reduces the firm's share and therefore the firm's incentives to invest. This limits the share that can be offered to the employee and therefore the extent to which the adverse selection problem can be mitigated. The decision to develop an idea internally or in a spinoff trades off the rent extraction of the employees with bad ideas with the efficient investment by the parent firm.

Due to the information asymmetry, keeping employees with good ideas in a division or in a spinoff comes at a cost, namely, increased wages for employees with bad ideas. Therefore, when the probability that an idea is good is low or when the rent left to agents with bad ideas is high, the employer lets employees with good ideas leave the firm and create inefficient spin-outs. The spin-outs implement good ideas by founders whose ability is lower than the ability of those who develop ideas in the parent firm's subsidiaries.

The consequence of the internal idea implementation process is that in case an employee comes up with a bad idea his expected payoff is higher than the expected payoff of an agent who comes up with a bad idea outside the firm. Therefore, the incentives to innovate within and outside the firm are different, which affects the characteristics of the pool of available ideas. The pool of internal innovations includes ideas with a lower likelihood of being good and a higher risk than the pool of outside innovations does.

Spin-out creation has attracted a substantial attention in terms of theoretical and empirical analysis. In what follows, I will discuss the contribution of the paper to the existing theories, the empirical evidence and how my results relate to it are discussed in the paper. One strand of the theoretical literature explains employees' departures as efficient outcomes (Pakes and Nitzan, 1983; Klepper and Sleeper, 2005; Cassiman and Ueda, 2006 among others). In these papers, spin-outs arise because the idea is less valuable if it is developed by the parent employer than in an independent new venture.

A second strand, which this paper is more closely related to, aims to explain the existence of inefficient spin-outs. Hellmann (2007) shows that when employees face a multitasking problem – work on the firm's core activity or innovate, committing *ex ante* not to develop employees' ideas and allow them to leave the firm *ex post*, reduces the incentives to innovate and increases the employee's effort in the core activity. In the present paper, the mechanism driving inefficient spin-outs is a mix of adverse selection between the employee and the parent firm and the need to motivate the firm to invest in the project. Similar to Hellmann, I also consider the employee's incentives to innovate. However, the focus of my paper is on the resulting different profiles of innovation initiated within the firm and innovation initiated outside the firm.

Amador and Landier (2003) study the implementation of employees' ideas within corporations or by venture capitalists when the entrepreneurs are overly optimistic about the quality of their ideas. The trade-off is between an exogenously set lower implementation cost if the idea is developed internally (by the parent employer), but also reduced contractual flexibility due to the impossibility to write a performance-based contract when the company finances the new project. Hvide and Kristiansen (2012) and Gambardell and Panico (2009) consider better informed researchers and some advantage from working with the parent firm. Hvide and Kristiansen (2012) consider a trade-off between increased outcome due to complementarities when the idea is developed internally and impossibility to write performance-based contracts in that case. Gambardell and Panico (2009) consider that the principal can use the delegation of decision-making authority in order to provide incentives to the privately informed researcher. My paper shows that in a setting where the parent firm's investment is endogenous, allowing the parent employer to write performance-based contracts (by allowing him to develop the employee's idea in a subsidiary) does not prevent the existence of spin-outs. Also, differently from Hvide and Kristiansen (2012) and Gambardell and Panico (2009), I show that the quality of the ideas developed in spin-outs depends on the degree of fit of the new idea with the activity of the parent firm. As the degree of fit decreases the quality of the ideas implemented in spin-outs increases.

Chatterjee and Rossi-Hansberg (2012) consider a setting in which workers have better information about their own ideas. An idea can either be sold to an entrepreneur or spun out and developed by the worker in a new independent venture. Thus, the mechanism driving the spin-outs is the adverse selection problem in the market for ideas. The authors also characterize the entry and growth process of firms, as well as the firm-size distribution. In my paper, I allow the parent employer to offer performance-based contracts to the employee by introducing the possibility of developing the new idea in a subsidiary of the parent firm. In a setting with exogenous synergy, adverse selection only drives spin-out creation as far as the principal does not have the possibility of writing a contract based on the innovation's outcome. Therefore, I show that the driver of spin-outs is the information asymmetry and the endogenous investment by the parent employer.

Anton and Yao (1995) study the problem of an employee who privately observes an idea and may either reveal it to the firm or develop it in a spin-out, which directly competes with the incumbent firm.[4] The rationale for spin-outs is due to the possibility that the firm might steal the idea and develop it on its own, without the employee. Thus, spin-outs will be prevented if the gains from avoiding competition for the incumbent firm are sufficiently high. In this paper, inefficient spin-outs are driven by the combination of adverse selection[5] and the endogenous investment by the parent firm. In addition, the present paper allows us to explain the driving forces of idea implementation in a division of the firm or in a subsidiary.

Differently from Anton and Yao (1995), Amador and Landier (2003), Gambardell and Panico (2009), Chatterjee and Rossi-Hansberg (2012), and Hvide and Kristiansen (2012), I also discuss the talent allocation problem that an employer deals with and show that the most talented employees develop their ideas internally, while the less talented ones leave and create spin-outs. Finally, my paper offers some implications in terms of the innovation profiles within and outside the firm.

The paper is also related to other work that analyzes the incentives to innovate. Anand and Galetovic (2000), for example, study how the possibility of an agent walking away with an idea affects corporations' and venture capitalists' incentives to invest in R&D. de Bettignies and Chemla (2008) consider a model of competition for talent between a venture capitalist and an established company. They show that the competition for talent fosters corporate venturing. The perspective of this paper is different, since I focus on the employee's incentives to innovate and on the consequences in terms of characteristics of the ideas explored within and outside the firm. Manso (2011) shows that the optimal contract that would motivate employees to engage in exploratory activities should be tolerant of failure. Similarly to Manso (2011), the reason for which employees are more likely to explore a new opportunity internally is the higher expected reward for employees with bad ideas. The difference is that rather than resulting from an incentive scheme designed by the firm, stronger incentives are the consequence of the internal implementation process of new ideas.

Finally, the paper also contributes to the literature aiming to explain the empirically documented positive stock price reaction around the announcement of a spinoff.[6] Aron (1991) argues that spinning-off an activity allows us to tie a manager's performance to the market valuation for that activity. Thus, the possibility of a spinoff increases the manager's incentives even if the spinoff rarely occurs. Nanda and Narayanan (1999) show that when there are information asymmetries about the value of the firm, between the firm and the investors, undervalued firms would spin off an activity in order to increase their market value before raising capital. In the present paper, developing an idea in a spinoff mitigates the internal information asymmetry and, differently from the previous articles, translates into increased efficiency of the core activity of the firm.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 discusses the optimal allocation of an employee with a good idea, shows that inefficient spin-outs may be created in equilibrium, and links the likelihood of creation and survival of spin-outs to the performance of the parent firm. Section 4 offers an extension of the model, it is considered that ideas can be of more than two types. Then, Section 5 discusses the differences between innovations initiated within and outside the firm. Section 6 concludes. All proofs are in the Appendix.

2. Model

2.1. Framework

A firm employs agents in a production activity (core activity hereafter) requiring some managerial ability. An employee's managerial ability is denoted as θ ($\theta \leq 1$), and the expected surplus from an employee with ability θ working in the core activity is $b\theta$. b is the exogenous return to talent in the core activity of the firm, can be affected by changes in the degree of competition, and evolves over the life-cycle of a product or activity.

At the beginning of the period of interest, a continuum of employees with mass one have innovative ideas (projects). A successfully implemented idea generates cash flow β. The cash flow in the case of success can be high (good idea) $\overline{\beta}$ with probability q, or low (bad idea) $\underline{\beta}$ with probability $(1-q)$. The outcome when the idea implementation fails is zero. Whether

[4] The vocabulary used in this paper differs from the one in Anton and Yao (1995), in their article: the employee can develop the idea independently in a start-up, with the parent firm in a spin-off, or the parent firm can implement an alternative internal idea rather than the idea of the employee.

[5] It is implicitly assumed that the employee can manipulate the information and therefore cannot credibly communicate the value of his idea to the parent firm. Then, the case where the employee develops his idea in a division of the firm could be interpreted as him selling the property rights to the parent employer in a strong property rights setting, *i.e.*, one where once the idea has been sold the employee cannot leave and implement it on his own.

[6] See for example Schipper and Smith (1983), Daley et al. (1997), Desai and Jain (1999), and Krishnaswami and Subramaniam (1999), among others.

an idea will succeed depends on the managerial ability of the agent who implements it.[7] An employee with ability θ succeeds and creates the cash flow β (where $\beta \in \{\underline{\beta}, \overline{\beta}\}$) with probability θ.

A new idea may be a new product, a new production process, or an insight into how to conquer a niche market not served by the parent firm; a new idea is an employee-driven innovation in a broad sense. To come up with an idea, an employee exploits some local knowledge and has better information about the value of the idea than the employer. For simplicity but without loss of generality, it is assumed that the employee perfectly observes the idea's quality β, while the employer knows only the distribution of good and bad ideas. The employee who is at the origin of an idea is the only one able to implement it.[8]

A new idea can be developed in a division of the parent firm, in a subsidiary of the parent employer (spinoff), or in a completely independent firm (spin-out) created by the employee. In the model, the funds needed to finance the project are normalized to zero. This is a simplifying assumption, and introducing an implementation cost does not qualitatively affect the results. If funds are needed and an employee is financially constrained, he could have access to a competitive venture capital market.[9]

The expected profit of an employee θ with an idea β who decides to create a new firm is $\beta\theta$, where $\beta = \{\underline{\beta}, \overline{\beta}\}$. If the new idea is developed in a division of the firm or in a spinoff, the parent employer can allocate some additional non-contractible resources to it. The parent firm's investment (synergy) S affects the returns of a successfully implemented new idea. The investment has an opportunity cost: $C(S) = cS^2/2$. To rule out pure cost considerations as driving forces of one of the organizational forms and focus the analysis on the role played by the information asymmetry, it is assumed that for a given S the cost is the same independent of the resources being allocated to a division of the firm or to a spinoff. I refer to the parent firm's investment as a synergy in order to capture the implicitly assumed advantage that the parent firm has in investing in the employee's project, compared to other firms. This advantage arises because the project is related to the capability of the parent firm, or because the employee has acquired some specific human capital that allows him to better use the parent firm's investment than the help of an alternative investor. Following this interpretation, the cost parameter c may be affected by the degree of fit between a new idea and the firm's existing activity(ies); namely, a stronger fit between the parent firm's activity and the new idea would imply a lower c.

The expected total surplus from developing an idea with the participation of the parent firm is $\beta\theta(1 + S) - C(S)$. The optimal level of investment is $S = \beta\theta/c$, so developing the idea with the involvement of the parent firm creates at most $\beta\theta + (\beta\theta)^2/2c$.

The difference between the division of the firm and the spinoff lies in the ability of third parties to assess the project's performance. If a project is developed in a division, then the revenue the project creates is part of the total revenue of the parent firm. Isolating and assessing the performance of a specific division is difficult (costly) for third parties, and the employer cannot offer a contract based on the project's performance. However, if a new idea is developed in a spinoff, since it is an independent unit, its revenue is easier to assess by third parties, and a performance-based contract can be offered. For example, if the principal wants to offer compensation tied to the market performance of the firm, if a project is developed in a spinoff, then the market valuation of the spinoff reflects the market valuation for the project only. If the idea is implemented in a division, the market valuation reflects the performance of the firm as a whole.

An employee who implements his idea – internally or in a new venture – is replaced by a new hire in the firm's core activity. New hires have an average ability of m, with $\theta > m$. An employee who has been in the firm has acquired human capital that outsiders do not have; thus, allocating an employee to the innovative activity has an opportunity cost which depends on the quality of the available labor m. The outside wage (*i.e.*, if an employee is hired by a different employer) for all employees is normalized to zero. Therefore, the outside opportunity of an employee with a good (*resp.* bad) idea is $\overline{\beta}\theta$ (*resp.* $\underline{\beta}\theta$).

Assumption 1.

(i) $b\theta - bm \geq \underline{\beta}\theta + (\underline{\beta}\theta)^2/2c$
(ii) $b\theta - bm \geq \overline{\beta}\theta$

The two conditions state (i) that it is always better to keep an agent with a bad idea in the core activity rather than allocating him to the innovative activity and (ii) that it is always profitable to keep an agent in the core activity rather than replacing him with an outsider. The focus of the analysis is on whether or not good ideas will be developed and if yes whether the implementation will be in relation with the parent employer or in an independent new venture. Relaxing the conditions of Assumption 1 would extend the analysis to cases where the bad ideas are also worth being developed internally, without affecting the results presented in the following sections.

[7] The idea that a successful entrepreneur needs to be a good innovator and a good manager is in the spirit of Lazear (2005), who depicts the entrepreneur as a Jack of all trades.
[8] At early stages of idea implementation, the innovator is critical.
[9] I do not need to assume that the employees are financially constrained in order to derive the results of the paper.

The timing of the employment relationship is the following:

- an employee discovers the value of his idea;
- the principal decides the allocation of employees to the core or innovative activity, and offers the corresponding menu of contracts;
- each employee decides to accept a contract from the menu or to leave the firm and create a new venture;
- the vacancies in the core activity – due to departures or relocation of employees to the innovative activity – are filled with new hires;
- the parent firm invests in the new activity whenever developed in a division of the firm or in a spinoff[10];
- outcomes are realized, and the contracts are executed.

2.2. The symmetric information case

As a benchmark, let us consider the case of symmetric information, *i.e.*, the employer observes the quality of the employee's idea. To prevent an employee with a good (*resp.* bad) idea from leaving the firm, the employer offers a fixed wage $\overline{\beta}\theta$ (*resp.* $\underline{\beta}\theta$). When the quality of the idea is common knowledge, it is in the employer's interest to offer an upfront fixed wage that satisfies the employee's participation constraint. Indeed, by doing so the employer becomes residual claimant and invests the optimal level $S=\overline{\beta}\theta/c$ in each innovative project.

Lemma 1.

- *If $b>\overline{b}$ (where $\overline{b}\equiv(\overline{\beta}\theta+(\overline{\beta}\theta)^2/2c)/(\theta-m)$), any employee with ability θ works in the core activity of the firm.*
- *If $b\le\overline{b}$, an employee θ with a good idea develops it in a division of the firm, and an employee θ with a bad idea works in the core activity.*

Since the surplus created by a good idea developed internally is larger than the surplus of a spin-out, if an idea is implemented, it is in a division of the company. Hereafter, I refer to the case where $b>\overline{b}$ as being a non-innovative regime, since good ideas are not valuable enough and the optimal allocation of talent consists of keeping the employees in the core activity. The case where $b\le\overline{b}$ is an innovative regime. Whether a firm is in an innovative or non-innovative regime is determined by the characteristics of the activity and the industry. If the returns to talent in the core activity decrease (due, for example, to increasing competition or changing customers' taste), then the firm is more likely to be in the innovative regime. Also if the available labor is with high expected ability (*i.e.*, higher m), good ideas are more likely to be implemented.

In what follows, we will see that when the information is asymmetric spin-outs and spinoffs are created in equilibrium.

3. Allocation of employees with asymmetric information

The principal's decision to allocate an employee to the core or innovative activity or to let the employee implement the idea in a spin-out will be discussed in two steps. I first characterize the optimal implementation of a good idea from the perspective of the parent employer – in an internal division, in a spinoff, or in a spin-out. Then I discuss the principal's decision to retain an employee with a good idea, in the core or innovative activity of the firm, or let him create a spin-out.

3.1. Optimal implementation of good ideas

Good ideas developed in divisions of the firm: If the good ideas are developed in divisions of the parent firm and since the performance is not *ex post* verifiable, the employer can only offer a lump sum payment to the employees with good ideas: $\overline{\beta}\theta$. The employer is a residual claimant of the innovative activity; therefore, he chooses the optimal level of investment $S=\overline{\beta}\theta/c$. To prevent agents with bad ideas from implementing them, the principal must offer $\overline{\beta}\theta$ in the core activity as well, and his expected profit is:

$$\Pi^d=q\left(\overline{\beta}\theta+\frac{\overline{\beta}^2\theta^2}{2c}+bm\right)+(1-q)b\theta-\overline{\beta}\theta \tag{1}$$

Good ideas developed in separate firms: If a good idea is developed in a spinoff, the principal can offer a contract (α, w), where α is the share of the realized cash flows offered to the employee, and w is the fixed wage paid by the principal.[11] The

[10] Since S is non-contractible, the principal chooses the value of the investment that maximizes his expected profit at this stage.

[11] A negative w would mean that the transfer is from the employee to the principal.

form of the contract considered does not affect the qualitative results of the paper as far as I focus on contracts between the parent firm and the employee and rule out budget breaking schemes.[12]

Under Assumption 1, I focus on values of the parameters for which it is always better to allocate employees with bad ideas to the core activity of the firm. Therefore, the menu of contracts $\{(\overline{\alpha}, \overline{w}), \underline{w}\}$ is such that the good ideas are implemented while the agents with bad ideas continue to work in the core activity. A contract $(\overline{\alpha} = 1, \overline{w} = 0)$, corresponds to the case where the employee is the sole owner of the cash flows generated by the idea, the parent employer does not invest in the new venture – the idea is implemented in a spin-out.[13]

The principal maximizes the total expected profit:

$$\max_{\overline{\alpha},\overline{w},\underline{w},S} \Pi^{spin} = q\left(bm + (1-\overline{\alpha})\overline{\beta}\theta(1+S) - \overline{w} - \frac{cS^2}{2}\right) + (1-q)(b\theta - \underline{w}) \tag{2}$$

subject to

$$\begin{cases} \overline{\alpha}\overline{\beta}(1+S)\theta + \overline{w} \geq \overline{\beta}\theta & \overline{IR} \\ \underline{w} \geq \underline{\beta}\theta & \underline{IR} \\ \overline{\alpha}\overline{\beta}(1+S)\theta + \overline{w} \geq \underline{w} & \overline{IC} \\ \underline{w} \geq \overline{\alpha}\underline{\beta}(1+S)\theta + \overline{w} & \underline{IC} \\ (1-\overline{\alpha})\overline{\beta}\theta - cS = 0 & IC_P \end{cases} \tag{3}$$

Equations $\overline{IR}$ and $\underline{IR}$ are the participation constraints of an agent with a good idea and a bad idea, respectively. Equations $\overline{IC}$ and $\underline{IC}$ are the incentive compatibility constraints; they guarantee that an employee with a good idea chooses to implement it ($\overline{IC}$), while an employee with a bad idea continues to work in the core activity ($\underline{IC}$).

The investment S in the innovative activity is not contractible *ex ante*. Once the contracts have been accepted, the principal chooses the investment that maximizes the expected profit of the spinoff[14]: $(1-\overline{\alpha})\overline{\beta}\theta(1+S) - \overline{w} - cS^2/2$, and equation IC_P is the principal's incentive compatibility constraint.[15] The resulting optimal menu of contracts is characterized below:

Proposition 1. *The menu of contracts that maximizes the parent firm's profit when good ideas are implemented is:*

$$\begin{cases} \overline{\alpha} = \min\{\dfrac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(2(\overline{\beta}-\underline{\beta})(1-q)+q\overline{\beta})}, \dfrac{c}{\overline{\beta}\theta}, 1\} \\ \overline{w} = (1-\overline{\alpha})\overline{\beta}\theta\left(1-\overline{\alpha}\dfrac{\overline{\beta}\theta}{c}\right) \end{cases}$$

$$\underline{w} = \overline{w} + \overline{\alpha}\underline{\beta}\theta\left(1 + \frac{(1-\overline{\alpha})\overline{\beta}\theta}{c}\right)$$

A contract $(\overline{\alpha} = 0, \overline{w} = \overline{\beta}\theta)$ is equivalent to developing an employee's good idea in a division of the company. In our setting, such a contract is never optimal, because an increase in the performance-based reward in the innovative activity makes it less attractive for an employee with a bad idea and allows the principal to offer a lower wage in order to keep such an employee in the core activity. Spinning off the innovative activity increases the expected profits of the whole, parent firm plus subsidiary. Thus, the paper offers a new mechanism through which spinning off an activity may increase the value of the firm.[16] Developing good ideas in spinoffs, rather than internal divisions, allows the parent firm to reduce the information rent of the employees with bad ideas, and improves the allocation of resources.[17]

The result that the spinoff is always the preferred way of implementing good ideas, when the parent firm is involved, is related to the assumption that the investment cost is the same for a division and for a subsidiary. In some cases, redeploying resources within the firm may come at a lower cost than doing it for a spinoff. For sufficient levels of cost differential, the internal division would become the best option for implementing good ideas and therefore the one adopted by the firm.

I consider two subcases based on the cost of the principal's investment. If the cost is sufficiently low ($c < \overline{\beta}\theta$), then the principal has the possibility of separating the employees with good ideas from those with bad ideas at no cost, i.e., without

[12] I rule out budget-breaking schemes in which a third party pays a bonus to the employee and the parent firm if the project attains a certain level of outcome, and is compensated by an initial transfer from the employee and the parent firm. A well-known problem with these schemes is that they are not robust to collusion (see, for example, Eswaran and Kotwal, 1984). A detailed discussion of this point is provided in Appendix A.1.

[13] In this case, the parent firm does not invest in the new venture and does not get anything from the realized outcome.

[14] This is equivalent to saying that the principal maximizes, ex post his total expected profit. Indeed, at the stage the principal chooses S the contracts have been accepted, the choice of S affects the total profit only by affecting the profit of the spinoff.

[15] Notice that for $\alpha > 0$ the investment of the parent firm is always lower than the first best investment. Indeed, whenever the idea is not implemented in a division of the firm, the parent employer is not a residual claimant of the outcome generated by the idea.

[16] See Section 1 for a discussion of the relevant empirical and theoretical literature.

[17] Ahn and Denis (2004) show that spinoffs allow to increase investment efficiency of the pair parent firm plus spinoff and that this increased efficiency at least partially explains the increase in firm value observed at the spinoff announcement.

paying an information rent to the employees with bad ideas in order to guarantee that they continue to work in the core activity. However, a high level of α decreases the principal's payoff if the idea is good in two ways: the principal gets a lower share of the outcome and invests less, which decreases the cash flow realized in the case of success. Therefore, the parent employer offers the share $\overline{\alpha} = c/\overline{\beta}\theta$ only if the probability that an idea will be good is sufficiently low. Otherwise, he will decrease the share offered to the employees with good ideas and offer a rent to the employees who are allocated to the core activity. The principal chooses $\overline{\alpha}$ by trading off these two effects: on one hand a higher share decreases the informational rent of the employees with bad ideas, but on the other hand it reduces the principal's incentives to invest in the spinoff thus decreasing the expected profit of the latter. When the fraction of good ideas is higher (*i.e.*, q is higher), it becomes more valuable to guarantee strong incentives to the principal and decrease $\overline{\alpha}$.[18]

If the synergy cost is high ($c > \overline{\beta}\theta$), then implementing good ideas in spinoffs always requires an increase in the wages in the core activity above $\underline{\beta}\theta$. In this case, it may be in the principal's interest to let employees with good ideas leave the company and create spin-outs.

Proposition 2. *If $q < \tilde{q}$, where $\tilde{q} \equiv ((\overline{\beta} - \underline{\beta})(c - \overline{\beta}\theta))/((\overline{\beta} - \underline{\beta})(c - \overline{\beta}\theta) + \overline{\beta}^2\theta)$, then from the parent firm's perspective it is optimal to develop a good idea in a spin-out.*

When deciding whether a good idea should be implemented in a spinoff or in a spin-out, the principal trades off the net expected benefit of developing a good idea in a spinoff with an increased reward for the agents with bad ideas. If the fraction of good ideas is low, the cost exceeds the benefit and the parent firm is better off if the employees with good ideas leave. As a result, spin-outs are more likely in environments where the probability for an employee to have a good idea is low. This probability may depend on the employee's characteristics, on the organizational and managerial choices of the employer, and on the characteristics of the activity. It can also be endogenous and depend on the employees' incentives to innovate, as will be discussed in Section 5.

The impact of the level of returns in the core activity (b) and the employee's talent (θ) on the likelihood of creating a spin-out is formally characterized in Propositions 4 and 5, and the corresponding discussion.

3.2. Allocation of talent

If an employee is allocated to the core activity, the quality of his idea is irrelevant for his performance. To keep an employee with a good idea in the core activity, the principal can only offer a fixed wage that matches the employee's outside opportunity: $\overline{\beta}\theta$. Since the employer does not observe the quality of the employee's idea, the employer cannot prevent an agent with a bad idea ($\underline{\beta}$) from claiming that the idea is good ($\overline{\beta}$). Whenever the principal wants to keep employees with good projects in the core activity, it is impossible to separate agents with good and bad ideas, and the principal offers a unique wage $\overline{\beta}\theta$ to all employees. The resulting expected profit is:

$$\Pi^c = b\theta - \overline{\beta}\theta \tag{4}$$

When deciding whether to allocate good employees to the core or innovative activity, the principal compares the profit from Eq. (4) to his optimal expected profit from the innovative activity:

$$\Pi^{spin} = q(bm + (1-\overline{\alpha})\overline{\beta}\theta\left(1 + \frac{(1-\overline{\alpha})\overline{\beta}\theta}{2c}\right) - \overline{w}) + (1-q)(b\theta - \underline{w}), \tag{5}$$

where $(\overline{\alpha}, \overline{w})$ and $\underline{w}$ are as defined in Proposition 1. This leads to the following results.

Proposition 3.

(i) *For $c > \overline{\beta}\theta$ and $q < \tilde{q}$*
  (1) *If $b < \hat{b}$, where $\hat{b} = (\underline{\beta}\theta + (\overline{\beta} - \underline{\beta}\theta)/q)/(\theta - m)$, then the good ideas are developed in spin-outs, and the employees with bad ideas work in the core activity of the firm.*
  (2) *If $b \geq \hat{b}$, then all employees work in the core activity of the firm.*
(ii) *For $c > \overline{\beta}\theta$ and $q \geq \tilde{q}$, and for $c < \overline{\beta}\theta$*
  (1) *If $b < \tilde{b}$, then the good ideas are developed in spinoffs, and the employees with bad ideas work in the core activity of the firm.*
  (2) *If $b \geq \tilde{b}$, then all employees work in the core activity of the firm, where $\tilde{b} \equiv (\overline{\beta}\theta + (1-\overline{\alpha}^2)(\overline{\beta}\theta)^2/2c + ((1-q)/q)\overline{\alpha}(\overline{\beta} - \underline{\beta})\theta(1 + (1-\overline{\alpha})\overline{\beta}\theta/c))/(\theta - m)$.*

[18] When designing the contract offered to employees who develop their ideas in spinoffs, the principal's trade-off is between the incentives of an employee with a bad idea to choose the core activity and the incentives of the principal to invest in the new idea. Indeed, the performance related part of an employee's payoff should be sufficiently high to make the innovative activity less attractive for an employee with a bad idea, but not too high in order not to destroy the principal's incentives to invest. My intuition is that this trade-off should be present for any contract that needs to satisfy the budget constraint $x_e(\beta, S) + x_p(\beta, S) = \beta\theta(1 + S)$. Therefore, allowing for more general contracts should not affect the qualitative results of the paper.

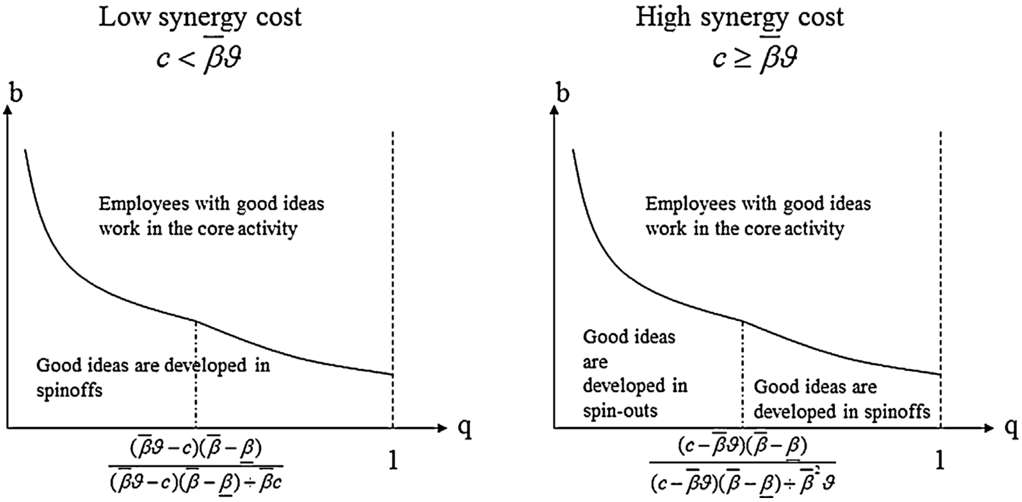

Fig. 1. The optimal allocation of employees with good ideas

The results of Proposition 3 are summarized in Fig. 1.

When the information about the quality of an idea is symmetric, the decision to allocate an employee to the core or innovative activity does not affect the wage bill of the parent employer. Therefore, the principal's decision trades off the marginal benefits of an employee's talent in each of the two activities. When information is asymmetric, whether the good ideas are implemented or not affects the wage cost of the parent employer. Indeed, keeping employees with good ideas in the core activity leads to higher information rent for the employees with bad ideas, compared to the case where good ideas are implemented in spinoffs or spin-outs. This leads to excessive innovation in the equilibrium with asymmetric information.

3.3. Firm's performance, employee's talent, spin-out creation, and survival

In what follows, I analyze the impact of the returns to talent in the core activity and the employee's managerial talent on the likelihood of spin-out creation. Each theoretical result is discussed in light of the existing empirical evidence.

Proposition 4. *The threshold $\hat{b}$ below which the employees with good ideas leave the firm decreases with the probability for an idea to be good* $\frac{\partial \hat{b}}{\partial q} \leq 0$.

From Proposition 4 and Fig. 1, we notice that for very high returns in the core activity, the benefit of keeping an employee is sufficiently high and spin-outs are less likely. Therefore, firms that perform better in their core activity have a lower likelihood of creating spin-outs. As the returns in the core activity decrease, the likelihood of spin-out creation increases. However as the returns in the core activity decrease further, it becomes more likely that a new idea will be developed in a spinoff rather than in a spin-out.

In recent empirical studies about spin-outs and spinoffs, particular attention has been devoted to tracing the new ventures and their parents, in order to analyze the rate at which firms spawn new ventures in the same industry and how the performance of the spawned units relates to the performance of the parent firm.

On the first point, papers applied to the automobile (Klepper, 2007), disk-drive (Agarwal et al., 2004), and laser (Klepper and Sleeper, 2005) industries show that better-performing firms are more likely to spawn spin-outs. This paper offers a theoretical rationale for the link between the performance of the parent firm and the likelihood of a spin-out being created. I show that the link is not monotone and depends on whether good ideas are valuable enough compared to the core activity of the firm. However, this does not contradict the empirical evidence. Klepper and Sleeper (2005) show that in the laser industry spawning of new ventures is most likely when firms reach middle age; *i.e.*, the spawning likelihood first increases and then decreases over the firm's life-cycle. If we consider that the rents of the firm in its core activity decrease over its life-cycle then the theoretical result of the model is consistent with this empirical finding.

The likelihood of an idea being implemented with the parent firm or in a spin-out also depends on the managerial talent of the employee who has come up with the idea.

Proposition 5. *When the managerial talent of an employee increases, spin-outs become less likely.*

An employee with higher managerial talent is more likely to be retained in the core activity of the parent firm or in a spin-off. Thus, the spin-outs implement good ideas by founders whose ability is lower than the ability of those who develop ideas in the parent firm's subsidiaries. At the implementation stage, as has been discussed, the founder is critical for the implementation of the idea. If we were to consider the evolution of the new venture, however, there is room for improvement in terms of managerial talent. The implication of Proposition 5, in that case, is that spinoffs should experience a lower managerial turnover compared to spin-outs.

Finally, even though the present paper does not explicitly model a knowledge transmission mechanism from the parent firm to its employees, the impact of such mechanisms on some parameters could be discussed. First, the quality distribution of the employees' ideas can be affected by the technological know-how of the parent firm. Employees working for a firm with strong technological know-how might be more likely to come up with a 'good' idea (*i.e.*, in such firms q would be higher). Second, as mentioned in the presentation of the model, the employee's managerial talent at least partially results from acquiring firm-specific human capital. Employees acquire a higher ability to manage ideas in firms with stronger market know-how.[19] The theoretical prediction of this reinterpretation would be that firms where both talents are high (*i.e.*, both θ and q are high) are less likely to spawn new ventures than those where one of the talents is high and the other low. This is consistent with the empirical finding of Agarwal et al. (2004), who analyze the impact of technological and market pioneering know-how on a firm's likelihood of spin-out creation. They find that in the disc drive industry, firms that are strong in both types of know-how generate fewer external ventures than those that are strong only in one of them.

By combining the results of Propositions 4 and 5, we can predict how the performance of the parent firm will affect the talent characteristics of the employees who create spin-outs.

Proposition 6. *The threshold of talent below which employees with good ideas leave the firm decreases with b.*

A decrease of b increases the fraction of spin-outs and the average ability of the employees who leave the firm. This would imply that a higher turn-over of managers should be observed in the spin-outs of companies that are performing better in their core activity.

4. More than two types

In this section, I consider that ideas can be of three types: $\beta \in \{\underline{\beta}, \hat{\beta}, \overline{\beta}\}$, where $\overline{\beta} > \hat{\beta} > \underline{\beta}$. As before, the employee knows the quality of his idea, and the employer knows only the distribution: $\underline{q}, \hat{q}, \overline{q}$ are the probabilities for an idea to be $\underline{\beta}, \hat{\beta}, \overline{\beta}$, respectively. Assumption 1 continues to hold. Thus, it is potentially worth implementing only ideas with $\beta \in \{\hat{\beta}, \overline{\beta}\}$.

The key trade-offs continue to hold in this setting. However, extending the analysis to three types of ideas allows me to discuss how the quality of the idea implemented in spin-outs depends on the degree of fit of the idea with the parent employer's activity. Hence, the focus of my discussion is on the cases where ideas are developed in spin-outs.[20]

If the cost of the synergy is very low ($c < \hat{\beta}\theta$), then the parent employer has the possibility to retain employees with ideas $\hat{\beta}$ and $\overline{\beta}$ without increasing the wage offered in the core activity above $\underline{\beta}\theta$. In this case, all innovation is happening in spin-offs.

Proposition 7. *For intermediate costs of the synergy $c \in (\hat{\beta}\theta, \overline{\beta}\theta)$, if both $\overline{q}$ and $\hat{q}$ are sufficiently low: the ideas $\overline{\beta}$ are implemented in spinoffs, the ideas $\hat{\beta}$ are implemented in spin-outs, and the employees with ideas $\underline{\beta}$ continue to work in the core activity of the firm.*

By offering a contract ($\overline{\alpha} = c/\overline{\beta}\theta, \overline{w} = 0$), the principal can separate the employees with ideas $\overline{\beta}$ from those with ideas $\underline{\beta}$ and $\hat{\beta}$ at no cost. However, it is in the principal's interest to offer such a contract only if the fraction of good ideas is sufficiently low. Indeed, the advantage of such strong incentives is the absence of rent extraction by the employees with less good ideas. The cost is the reduced incentives for the principal to invest in the innovative activity. Therefore, the principal is willing to offer this contract only if $\overline{q}$ is sufficiently low. In this case, the decision to retain the employees with ideas $\hat{\beta}$ responds to the following trade-off: keeping these employees increases the expected outcome from developing the ideas, but at the other hand, it increases the wage cost of employees with bad ideas who continue to work in the core activity. If $\hat{q}$ is sufficiently low, then the cost exceeds the benefit, and the ideas $\hat{\beta}$ are developed in spin-outs.

For the intermediate costs of the synergy, if one observes innovation in spin-outs and in spinoffs, the quality of the ideas implemented in spinoffs exceeds the quality of the ideas developed in spin-outs.

Proposition 8. *For high costs of the synergy ($c > \overline{\beta}\theta$):*

(i) *If both $\hat{q}$ and $\overline{q}$ are sufficiently low, then the ideas $\hat{\beta}$ and $\overline{\beta}$ are developed in spin-outs, and the employees with ideas $\underline{\beta}$ work in the core activity.*
(ii) *If only $\overline{q}$ is sufficiently low, then the ideas $\overline{\beta}$ are developed in spin-outs, the ideas $\hat{\beta}$ are implemented in spin-offs, and the employees with ideas $\underline{\beta}$ work in the core activity.*

For high costs of the synergy, keeping the employees with ideas $\overline{\beta}$ also comes at a cost. Therefore, the principal has to decide whether to let those employees leave the company or not.

[19] In Franco and Filson (2006), the employee learns the employer's know-how with some probability.
[20] The formal analysis is in Appendix A.6.

If the investment cost is related to the degree of fit between the new ideas and the activity of the firm, *i.e.*, a stronger fit corresponds to lower investment cost, from Propositions 7 and 8, it follows that as the degree of fit decreases the quality of the ideas developed in spin-outs increases.[21]

5. Incentives to innovate

The focus of the paper thus far has been on the development of employee-driven innovative ideas related to the employer's capability. Understanding how new ideas are developed is an important stage of the innovation process and has direct implications for the agents' incentives to innovate.

The type of innovations considered are employee or agent driven, and the discussion is about the employee's incentives to innovate and not about the firm's (or venture capitalist's) incentives to finance early stages of the R&D process. The difference between an insider (employee) and an outsider (agent) is the following: an employee by working for the firm is exposed to internal information, knowledge, technology; therefore, his idea (if any) would have a stronger fit with the parent firm's capability. However, there is no fit between the outsiders' ideas and the firm's activity; therefore, outsiders' ideas can be implemented only independently from the firm. In what follows, we will see whether more innovative effort will be carried on internally or outside the firm, and whether the internal and external innovations differ due to the potential differences of incentives to innovate.

Let us consider that an agent or an employee faces an opportunity that he can decide to explore by spending a non-contractible effort with a cost I. If the exploration takes place (*i.e.*, the effort is spent), he comes up with a new idea that can be good ($\overline{\beta}$) with probability q or bad ($\underline{\beta}$) with probability $1-q$. After the exploration phase, he is the only one who knows the exact quality of the idea ($\overline{\beta}$ or $\underline{\beta}$). The employee and the agent have the same managerial talent θ. It is also assumed that it is not worth investing in the innovative activity if one is sure to come up with a bad idea.

Assumption 2. $\underline{\beta}\theta < I < \overline{\beta}\theta$

Whether the inventor is an employee or an outsider affects if and how his idea would be implemented and hence his expected payoff. An outside agent can implement an idea only on his own.[22] Therefore, the agent's expected payoff if the idea is good is $\overline{\beta}\theta$, and if it is bad, the payoff is $\underline{\beta}\theta$. An agent outside the firm invests in an exploratory activity only if the probability of coming up with a good idea is sufficiently high:

$$(q\overline{\beta}\theta + (1-q)\underline{\beta}\theta) \geq I \Rightarrow q \geq \frac{1}{\theta(\overline{\beta}-\underline{\beta})}(I-\underline{\beta}\theta) \tag{6}$$

Let us now consider an employee's incentives to innovate. For the parent employer, it is impossible to commit before the innovation stage on future payoffs. This implies that the decisions made at the implementation stage should maximize the parent employer's expected profit at that point in time. Therefore, the parent firm's decisions and the expected payoffs of an employee who has an idea are as described in Section 3. If an employee's idea is good, his payoff is $\overline{\beta}\theta$. The expected payoff when the idea is bad depends on whether good ideas are implemented and how. If the good ideas are not implemented, *i.e.*, all employees are retained in the core activity of the firm, then the payoff of an employee with a bad idea is $\overline{\beta}\theta$. If the good ideas are implemented in spinoffs, an employee with a bad idea is offered $\underline{w} = \overline{\beta}\theta - \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c) \geq \underline{\beta}\theta$. If employees with good ideas leave the company to create spin-outs, an employee with a bad idea receives $\underline{\beta}\theta$.

To give the intuition for the following proposition, let us consider that the parameters satisfy the conditions under which good ideas are implemented in spinoffs.[23] In this case, an employee explores an opportunity if:

$$(q\overline{\beta}\theta + (1-q)\underline{w}) \geq I \Rightarrow q \geq \frac{I-\underline{w}}{\overline{\beta}\theta-\underline{w}} \tag{7}$$

For $\underline{w} \geq \underline{\beta}\theta$, the following inequality holds $(I-\underline{w})/(\overline{\beta}\theta-\underline{w}) \leq (I-\underline{\beta}\theta)/(\overline{\beta}\theta-\underline{\beta}\theta)$.

Proposition 9. *The threshold value for q above which ideas are explored by an employee is lower than or equal to that threshold for an outsider.*

For all values of the parameters for which the allocation of employees with good ideas, to the core or innovative activity, increases the reward of the employees with bad ideas above $\underline{\beta}\theta$, there is a distortion in the employees' incentives to innovate.

[21] Increasing the number of types adds significant complexity to the analysis. However, my intuition is that the results found in this section should be extendable to a setting with more than three types. Indeed, employees with ideas $\beta > \hat{\beta}$, where $\hat{\beta}\theta = c$, can be retained without distorting the incentives of the employees with lower types, therefore these ideas should always be developed in spinoffs. Developing the ideas $\beta < \hat{\beta}$ in spinoffs would distort the incentives of those who are more valuable when retained in the core activity. The decision to develop the ideas in spinoffs or in spin-outs should respond to the previous trade-off: keeping these employees would increase the expected outcome from developing their ideas, but at the other hand it would also increase the wage cost of the employees who are retained in the core activity of the firm.

[22] If implementation funds were required, he would raise them from a venture capital firm.

[23] The formal discussion and the proof of Proposition 9 are in Appendix A.7.

The firm offers an environment with stronger incentives to explore because the rewards if the idea is not good are higher. Thus, within the firm, opportunities with a lower probability of turning into good ideas are explored.

Another implication of the endogeneization of the innovation process is that spin-outs are more likely to occur when the exploration cost is low. Otherwise, only opportunities that will be developed in internal divisions or spinoffs will be considered.

Under the present specification of the innovative process, there is excessive exploration within the firm. However, the result that employees exert too much effort is not robust to the way exploration is modeled. Under a different specification, we may observe too little innovative effort within the firm, as shown in Appendix A.8. However, the result that is robust to the way the innovation process is modeled and therefore is the one that should be emphasized is that the pool of ideas explored internally is different from the pool of ideas explored by outsiders. Indeed, the average quality of ideas explored internally is lower than the average quality of ideas explored outside the firm.

6. Conclusion

This paper proposed a theoretical explanation for two related questions, what drives inefficient spin-outs and what trade-offs a firm faces when it decides to develop an activity in an internal division or in a spinoff. The paper showed that the performance of the firm in its core activity affects the likelihood of spin-out creation and the performance of spin-outs and spinoffs. Then the innovation stage has been analyzed, and we saw that more risky ideas are more likely to be explored internally than outside the firm.

The paper focused on two stages of the innovation process: the agent's decision to explore or not a new opportunity and the implementation decision by the parent firm or an outside investor. An additional step of the analysis would be to consider an endogenous interaction between the firm's core activity and the implemented new ideas. This could provide insights into intra-industry dynamics and the product's life-cycle.

Another aspect that has been left aside and that in my view would represent an interesting direction for further thoughts is the eventual need for financing at the exploration stage and the consequences it would have on the characteristics of the portfolios of ideas financed by venture capitalists and by corporations.

Acknowledgements

I would like to thank the editor Professor Gresik, the associate editor and three anonymous referees for their thorough and helpful comments. The paper has benefited from helpful comments by Daniel Ferreira, Luis Garicano, Michael Raith, Daniel Spulber and the participants at the Fourth Annual Searle Center Conference on Entrepreneurship and Innovation. A previous version of the paper has circulated under the title "Spinoffs". The usual disclaimer applies.

Appendix A.

A.1. Discussion of the generality of the contracts

In order to reduce the information rent captured by the employees with bad ideas, the principal needs to increase the performance-based reward of the employees with good ideas. However, under the assumption that the budget is balanced (*i.e.*, the cash flow y is shared between the principal and the employee) this implies that the performance-based reward offered to the principal is lower and therefore his incentives to invest into the project are lower.

This trade-off is not affected by the specifics of the contract under the balanced budget assumption. If I assume that there is a budget breaker, then he could offer a contract that offers a bonus to the employee and to the parent firm only if a specific level of outcome is attained (*i.e.*, if the outcome is $\bar{y} = \overline{\beta}(1 + \overline{\beta}\theta/c)$). The employee and the parent firm will need to make upfront payments to the third party in order to ensure that the the budger breaker's participation constraint is satisfied. An unappealing property of this types of contracts is that the budget breaker is worst off when the outcome is higher, indeed if the threshold $\bar{y}$ is not attained then the third party does not need to pay the bonuses. This property creates room for collusion between the third party and one of the contractors. A detailed discussion of the problem can be found in Eswaran and Kotwal (1984).

A.2. Proof of Lemma 1

By assumption it is optimal to always allocate the agents with bad ideas to the core activity of the firm. The expected profit from allocating an employee with a good idea to the core activity is: $\pi^c = b\theta - \overline{\beta}\theta$, the expected profit if the employee's idea is developed in a division of the firm is: $\pi^d = \overline{\beta}\theta + \overline{\beta}^2\theta^2/2c - \overline{\beta}\theta + bm$. The threshold value $\bar{b}$ is given by $\pi^c = \pi^d$.

A.3. Proof of Propositions 1 and 2

When the good ideas are developed in a spinoff the parent firm maximizes its expected profit:

$$\max_{\bar{\alpha},\bar{w},\underline{w},S} \Pi^{spin} = q\left(bm + (1-\bar{\alpha})\bar{\beta}\theta(1+S) - \bar{w} - \frac{cS^2}{2}\right) + (1-q)(b\theta - \underline{w}) \tag{8}$$

subject to

$$\begin{cases} \bar{\alpha}\bar{\beta}(1+S)\theta + \bar{w} \geq \bar{\beta}\theta & \overline{IR} \\ \underline{w} \geq \underline{\beta}\theta & \underline{IR} \\ \bar{\alpha}\bar{\beta}(1+S)\theta + \bar{w} \geq \underline{w} & \overline{IC} \\ \underline{w} \geq \bar{\alpha}\underline{\beta}(1+S)\theta + \bar{w} & \underline{IC} \\ (1-\bar{\alpha})\bar{\beta}\theta - cS = 0 & IC_P \end{cases} \tag{9}$$

S is given by the principal's incentive compatibility constraint (IC_P):

$$S = \frac{(1-\bar{\alpha})\bar{\beta}\theta}{c} \tag{10}$$

A higher $\underline{w}$ decreases the profit and makes the $\overline{IC}$ constraint more difficult to satisfy. The principal chooses the lowest possible $\underline{w}$, satisfying both $\underline{IR}$ and $\underline{IC}$, hence $\underline{w} = \max\{\underline{\beta}\theta, \bar{\alpha}\underline{\beta}\theta(1+S) + \bar{w}\}$, where $S = (1-\bar{\alpha})\bar{\beta}\theta/c$.

$\overline{IC}$ can be rewritten as:

$$\bar{\alpha}\bar{\beta}\theta(1+S) + \bar{w} \geq \max\{\underline{\beta}\theta, \bar{\alpha}\underline{\beta}\theta(1+S) + \bar{w}\} \tag{11}$$

If $\overline{IR}$ holds, then the inequality above is always satisfied and $\overline{IC}$ is never binding.

A higher $\bar{w}$ decreases the profit and makes the $\underline{IC}$ constraint more difficult to satisfy. Therefore the principal chooses the lowest possible $\bar{w}$, satisfying $\overline{IR}$. The individual rationality constraint of the high type ($\overline{IR}$) is always binding and $\bar{w} = \bar{\beta}\theta - \bar{\alpha}\bar{\beta}\theta(1 + (1-\bar{\alpha})\bar{\beta}\theta/c)$, this can be rewritten as follows: $\bar{w} = \bar{\beta}\theta(1-\bar{\alpha})(1-\bar{\alpha}\bar{\beta}\theta/c)$.

The simplified program, after replacing for S and $\bar{w}$, writes:

$$\max_{\bar{\alpha},\underline{w}} \Pi^{spin} = q\left(bm + (1-\bar{\alpha}^2)\frac{\bar{\beta}^2\theta^2}{2c}\right) + (1-q)(b\theta - \underline{w}) \tag{12}$$

subject to

$$\begin{cases} -\underline{w} + \underline{\beta}\theta \leq 0 & (\underline{IR}) & \lambda \\ -\underline{w} + \bar{\beta}\theta - \bar{\alpha}(\bar{\beta} - \underline{\beta})\theta\left(1 + \frac{(1-\bar{\alpha})\bar{\beta}\theta}{c}\right) \leq 0 & (\underline{IC}) & \gamma \end{cases} \tag{13}$$

λ and γ are the multipliers of the individual rationality and incentive compatibility constraints of $\underline{\theta}$, respectively.

$$L = q\left(bm + (1-\bar{\alpha}^2)\frac{\bar{\beta}^2\theta^2}{2c}\right) + (1-q)(b\theta - \underline{w}) - \lambda(-\underline{w} + \underline{\beta}\theta) - \gamma\left(-\underline{w} + \bar{\beta}\theta - \bar{\alpha}(\bar{\beta} - \underline{\beta})\theta\left(1 + \frac{(1-\bar{\alpha})\bar{\beta}\theta}{c}\right)\right) \tag{14}$$

The solution needs to satisfy the following conditions:

$$\begin{cases} \dfrac{\partial L}{\partial \underline{w}} = -(1-q) + \lambda + \gamma = 0 \\ \dfrac{\partial L}{\partial \bar{\alpha}} = -q\bar{\alpha}\dfrac{\bar{\beta}^2\bar{\theta}^2}{c} + \gamma(\bar{\beta} - \underline{\beta})\theta\left(1 + \dfrac{(1-2\bar{\alpha})\bar{\beta}\theta}{c}\right) = 0 \\ \dfrac{\partial L}{\partial \lambda} = \underline{w} - \underline{\beta}\theta \geq 0 \\ \dfrac{\partial L}{\partial \gamma} = \underline{w} - \bar{\beta}\theta + \bar{\alpha}(\bar{\beta} - \underline{\beta})\theta\left(1 + \dfrac{(1-\bar{\alpha})\bar{\beta}\theta}{c}\right) \geq 0 \end{cases} \tag{15}$$

- Case 1: $\lambda = 0$ and $\gamma = 0$, this corresponds to a case where both constraints are slack and it is immediate to see that this is not a solution.

- Case 2: $\lambda > 0$ and $\gamma = 0$, this corresponds to a case where the binding constraint is $\underline{IR}$. In this case it is in the principal's interest to set $\bar{\alpha} = 0$ which in turn violates the $\underline{IC}$ constraint. Therefore this cannot be a solution.

- Case 3: $\lambda = 0$ and $\gamma > 0$. (15) becomes:

$$\begin{cases} \dfrac{\partial L}{\partial \underline{w}} = -(1-q) + \gamma = 0 \\ \dfrac{\partial L}{\partial \overline{\alpha}} = -q\overline{\alpha}\dfrac{\overline{\beta}^2\overline{\theta}^2}{c} + \gamma(\overline{\beta}-\underline{\beta})\theta\left(1+\dfrac{(1-2\overline{\alpha})\overline{\beta}\theta}{c}\right) = 0 \\ \underline{w} - \underline{\beta}\theta \geq 0 \\ \underline{w} = \overline{\beta}\theta - \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta\left(1+\dfrac{(1-\overline{\alpha})\overline{\beta}\theta}{c}\right) \end{cases} \tag{16}$$

From the first equation $\gamma = 1 - q$. After replacing $\gamma = 1 - q$ in the second equation, I obtain $\overline{\alpha}$:

$$-q\overline{\alpha}\frac{\overline{\beta}^2\overline{\theta}^2}{c} + (1-q)(\overline{\beta}-\underline{\beta})\theta(1+\frac{(1-2\overline{\alpha})\overline{\beta}\theta}{c}) = 0 \Leftrightarrow \overline{\alpha} = \frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(q\overline{\beta}+2(1-q)(\overline{\beta}-\underline{\beta}))} \tag{17}$$

$\underline{w} = \overline{\beta}\theta - \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c})$, satisfies the condition $\underline{w} \geq \underline{\beta}\theta$ if the following condition holds: $\overline{\alpha} \leq \min\{1, \frac{c}{\overline{\beta}\theta}\}$.[24]

If $c > \overline{\beta}\theta$, then $\overline{\alpha} = \frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(q\overline{\beta}+2(1-q)(\overline{\beta}-\underline{\beta}))}$, only if $\frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(q\overline{\beta}+2(1-q)(\overline{\beta}-\underline{\beta}))} < 1$, which gives us the following condition: $q \geq \frac{(\overline{\beta}-\underline{\beta})(c-\overline{\beta}\theta)}{\overline{\beta}^2\theta+(\overline{\beta}-\underline{\beta})(c-\overline{\beta}\theta)}$.

If $c < \overline{\beta}\theta$, then $\overline{\alpha} = \frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(q\overline{\beta}+2(1-q)(\overline{\beta}-\underline{\beta}))}$, only if $\frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(q\overline{\beta}+2(1-q)(\overline{\beta}-\underline{\beta}))} < \frac{c}{\overline{\beta}\theta}$, which implies that the following condition needs to hold: $q \geq \frac{(\overline{\beta}-\underline{\beta})(\overline{\beta}\theta-c)}{\overline{\beta}c+(\overline{\beta}-\underline{\beta})(\overline{\beta}\theta-c)}$

- Case 4: $\lambda > 0$ and $\gamma > 0$. (15) becomes:

$$\begin{cases} \dfrac{\partial L}{\partial \underline{w}} = -(1-q) + \lambda + \gamma = 0 \\ \dfrac{\partial L}{\partial \overline{\alpha}} = -q\overline{\alpha}\dfrac{\overline{\beta}^2\overline{\theta}^2}{c} + \gamma(\overline{\beta}-\underline{\beta})\theta\left(1+\dfrac{(1-2\overline{\alpha})\overline{\beta}\theta}{c}\right) = 0 \\ \underline{w} = \underline{\beta}\theta \\ \underline{w} = \overline{\beta}\theta - \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta\left(1+\dfrac{(1-\overline{\alpha})\overline{\beta}\theta}{c}\right) \end{cases} \tag{18}$$

From the last two equations, we obtain that $\overline{\alpha} = 1$ or $\overline{\alpha} = \frac{c}{\overline{\beta}\theta}$.

Subcase $\overline{\alpha} = 1$.

$\gamma = \frac{q\overline{\beta}^2\theta}{(\overline{\beta}-\underline{\beta})(c-\overline{\beta}\theta)}$. Therefore, $\gamma > 0$ only if $c > \overline{\beta}\theta$.

$\lambda = 1 - q - \frac{q\overline{\beta}^2\theta}{(\overline{\beta}-\underline{\beta})(c-\overline{\beta}\theta)}$. $\lambda > 0$ only if $q < \frac{(\overline{\beta}-\underline{\beta})(c-\overline{\beta}\theta)}{(\overline{\beta}-\underline{\beta})(c-\overline{\beta}\theta)+\overline{\beta}^2\theta}$.

Subcase $\overline{\alpha} = \frac{c}{\overline{\beta}\theta}$.

$\gamma = \frac{q\overline{\beta}c}{(\overline{\beta}-\underline{\beta})(\overline{\beta}\theta-c)}$. Therefore, $\gamma > 0$ only if $\overline{\beta}\theta > c$.

$\lambda = 1 - q - \frac{q\overline{\beta}c}{(\overline{\beta}-\underline{\beta})(\overline{\beta}\theta-c)}$. $\lambda > 0$ only if $q < \frac{(\overline{\beta}-\underline{\beta})(\overline{\beta}\theta-c)}{(\overline{\beta}-\underline{\beta})(\overline{\beta}\theta-c)+\overline{\beta}c}$.

To summarize the results, depending on the cost of the principal's investment and the distribution of ideas.

If $c < \overline{\beta}\theta$

[24] Since I am assuming balanced budget $\overline{\alpha} \in [0, 1]$.

(i) If $q < \frac{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})}{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})+\overline{\beta}c}$ then the optimal menu of contracts is: $(\overline{\alpha} = \frac{c}{\overline{\beta}\theta}, \overline{w} = 0)$ and $\underline{w} = \underline{\beta}\theta$

(ii) If $q \geq \frac{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})}{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})+\overline{\beta}c}$ then the optimal menu of contracts is: $(\overline{\alpha} = \frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(2(\overline{\beta}-\underline{\beta})(1-q)+q\overline{\beta})}, \overline{w} = \overline{\beta}\theta(1-\overline{\alpha})(1-\overline{\alpha}\frac{\overline{\beta}\theta}{c}))$ and $\underline{w} = \overline{\beta}\theta - \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c})$

If $c \geq \overline{\beta}\theta$

(i) If $q < \frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}$ then the optimal menu of contracts is: $(\overline{\alpha} = 1, \overline{w} = 0)$ and $\underline{w} = \underline{\beta}\theta$

(ii) If $q \geq \frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}$ then the optimal menu of contracts is: $(\overline{\alpha} = \frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(2(\overline{\beta}-\underline{\beta})(1-q)+q\overline{\beta})}, \overline{w} = \overline{\beta}\theta(1-\overline{\alpha})(1-\overline{\alpha}\frac{\overline{\beta}\theta}{c}))$ and $\underline{w} = \overline{\beta}\theta - \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c})$

A.4. Proof of Proposition 3

In order to decide whether to allocate an employee to the core or innovative activity the principal compares the expected profit when the employee works in the core activity to the expected payoff when the employee works in the innovative activity:

$$\Pi^c = b\theta - \overline{\beta}\theta \tag{19}$$

$$\Pi^{spin} = q\left(bm + \frac{(1-\overline{\alpha}^2)\overline{\beta}^2\theta^2}{2c}\right) + (1-q)\left(b\theta - \overline{\beta}\theta + \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta\left(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c}\right)\right) \tag{20}$$

$\tilde{b}$ is given by $\Pi^c = \Pi^{spin}$.

We can characterize the value of the threshold depending on the contract offered to the employees with good ideas.

For $c < \overline{\beta}\theta$

- If $q < \frac{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})}{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})+\overline{\beta}c}$, then the contract offered to employees with good ideas is $(\overline{\alpha} = c/\overline{\beta}\theta, \overline{w} = 0)$. In this case $\tilde{b}$ becomes:

$$\frac{(\overline{\beta}\theta)^2/2c + \overline{\beta}\theta - c/2 + ((1-q)/q)(\overline{\beta}-\underline{\beta})\theta}{\theta - m}.$$

- If $q \geq \frac{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})}{(\overline{\beta}\theta-c)(\overline{\beta}-\underline{\beta})+\overline{\beta}c}$, then:

$$\tilde{b} = \frac{\overline{\beta}\theta + (1-\overline{\alpha}^2)(\overline{\beta}\theta)^2/2c + ((1-q)/q)\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}{\theta - m},$$

where

$$\overline{\alpha} = \frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(2(\overline{\beta}-\underline{\beta})(1-q)+q\overline{\beta})}.$$

For $c \geq \overline{\beta}\theta$

- If $q < \frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}$, then the contract offered to the employees with good ideas is $(\overline{\alpha}=1, \overline{w}=0)$, *i.e.*, good ideas are developed in spin-outs. In this case $\tilde{b}$ becomes:

$$\frac{\underline{\beta}\theta + (\overline{\beta}-\underline{\beta})\theta/q}{\theta - m} \equiv \hat{b}$$

- If $q \geq \frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}$, then:

$$\tilde{b} = \frac{\overline{\beta}\theta + (1-\overline{\alpha}^2)(\overline{\beta}\theta)^2/2c + ((1-q)/q)\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}{\theta - m},$$

where

$$\overline{\alpha} = \frac{(1-q)(\overline{\beta}-\underline{\beta})(c+\overline{\beta}\theta)}{\overline{\beta}\theta(2(\overline{\beta}-\underline{\beta})(1-q)+q\overline{\beta})}$$

A.5. Proof of Propositions 4, 5, and 6

Proof of Proposition 4 From $\hat{b} = \frac{\underline{\beta}\theta+(\overline{\beta}-\underline{\beta})\theta/q}{\theta-m}$, it is immediate to see that $\frac{\partial \hat{b}}{\partial q} < 0$.

Proof of Proposition 5 In order to prove the proposition we show that both $\hat{b}$ and $\tilde{q}$ decrease with θ.

$$\frac{\partial \tilde{q}}{\partial \theta} = -\frac{(\overline{\beta}-\underline{\beta})\overline{\beta}^2 c}{((c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta)^2} < 0 \tag{21}$$

$\hat{b}$ can be rewritten:

$$\hat{b} = \frac{\underline{\beta}+(\overline{\beta}-\underline{\beta})/q}{1-m/\theta} \tag{22}$$

it follows immediately that $\partial\hat{b}/\partial\theta < 0$.

Proof of Proposition 6

The values of θ for which an employee with a good idea leaves, are given by the following inequality:

$$qbm + (1-q)(b\theta - \underline{\beta}\theta) \geq b\theta - \overline{\beta}\theta \tag{23}$$

This is equivalent to:

$$qbm \geq \theta(qb - q\underline{\beta} - \overline{\beta} + \underline{\beta}) \tag{24}$$

If $b \leq \underline{\beta} + \frac{\overline{\beta}-\underline{\beta}}{q}$, then the above inequality holds for any θ.

If $b > \underline{\beta} + \frac{\overline{\beta}-\underline{\beta}}{q}$, then the inequality holds if:

$$\theta \leq \frac{bm}{(qb - q\underline{\beta} - \overline{\beta} + \underline{\beta})} \tag{25}$$

It is immediate to see that the right hand side of the inequality decreases with b.

A.6. Proofs for $\beta \in \{\underline{\beta}, \hat{\beta}, \overline{\beta}\}$

With three types, the principal maximizes:

$$\max_{\underline{w},\hat{w},\hat{\alpha},\overline{w},\overline{\alpha}} \Pi = \underline{q}(b\theta - \underline{w}) + \hat{q}\left(bm + \hat{\beta}\theta(1-\hat{\alpha})\left(1+\frac{\hat{\beta}\theta(1-\hat{\alpha})}{2c}\right) - \hat{w}\right) + \overline{q}\left(bm + \overline{\beta}\theta(1-\overline{\alpha})\left(1+\frac{\overline{\beta}\theta(1-\overline{\alpha})}{2c}\right) - \overline{w}\right) \tag{26}$$

subject to:

$$\begin{cases} \overline{\beta}\theta-\overline{w}-\overline{\beta}\theta\overline{\alpha}\left(1+\dfrac{\overline{\beta}\theta(1-\overline{\alpha})}{c}\right)\leq 0 & \overline{IR} \quad (A)\\ \hat{\beta}\theta-\hat{w}-\hat{\beta}\theta\hat{\alpha}\left(1+\dfrac{\hat{\beta}\theta(1-\hat{\alpha})}{c}\right)\leq 0 & \hat{IR} \quad (B)\\ -\underline{w}+\hat{w}+\underline{\beta}\theta\hat{\alpha}\left(1+\dfrac{\hat{\beta}\theta(1-\hat{\alpha})}{c}\right)\leq 0 & \underline{IC}_1 \quad (C)\\ -\underline{w}+\overline{w}+\underline{\beta}\theta\overline{\alpha}\left(1+\dfrac{\overline{\beta}\theta(1-\overline{\alpha})}{c}\right)\leq 0 & \underline{IC}_2 \quad (D)\\ -\hat{w}-\hat{\beta}\theta\hat{\alpha}\left(1+\dfrac{\hat{\beta}\theta(1-\hat{\alpha})}{c}\right)+\overline{w}+\hat{\beta}\theta\overline{\alpha}\left(1+\dfrac{\overline{\beta}\theta(1-\overline{\alpha})}{c}\right)\leq 0 & \hat{IC} \quad (E)\\ -\overline{w}-\overline{\beta}\theta\overline{\alpha}\left(1+\dfrac{\overline{\beta}\theta(1-\overline{\alpha})}{c}\right)+\hat{w}+\overline{\beta}\theta\hat{\alpha}\left(1+\dfrac{\hat{\beta}\theta(1-\hat{\alpha})}{c}\right)\leq 0 & \overline{IC} \quad (F)\\ -\underline{w}+\underline{\beta}\theta<0 & \underline{IR} \quad (G) \end{cases} \tag{27}$$

The solution of the programme needs to satisfy:

$$\begin{aligned} \frac{\partial L}{\partial \underline{w}} &= -\underline{q}+C+D+G=0\\ \frac{\partial L}{\partial \hat{w}} &= -\hat{q}-C+E-F+B=0\\ \frac{\partial L}{\partial \overline{w}} &= -\overline{q}+A-D-E+F=0\\ \frac{\partial L}{\partial \hat{\alpha}} &= -\hat{q}\hat{\beta}\theta(1+\frac{(1-\hat{\alpha})\hat{\beta}\theta}{c})+B\hat{\beta}\theta\left(1+\frac{(1-2\hat{\alpha})\hat{\beta}\theta}{c}\right)-C\underline{\beta}\theta\left(1+\frac{(1-2\hat{\alpha})\hat{\beta}\theta}{c}\right)\\ &\quad +E\hat{\beta}\theta\left(1+\frac{(1-2\hat{\alpha})\hat{\beta}\theta}{c}\right)-F\overline{\beta}\theta\left(1+\frac{(1-2\hat{\alpha})\hat{\beta}\theta}{c}\right)=0\\ \frac{\partial L}{\partial \overline{\alpha}} &= -\overline{q}\overline{\beta}\theta\left(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c}\right)+A\overline{\beta}\theta\left(1+\frac{(1-2\overline{\alpha})\overline{\beta}\theta}{c}\right)-D\underline{\beta}\theta\left(1+\frac{(1-2\overline{\alpha})\overline{\beta}\theta}{c}\right)\\ &\quad -E\hat{\beta}\theta\left(1+\frac{(1-2\overline{\alpha})\overline{\beta}\theta}{c}\right)+F\overline{\beta}\theta\left(1+\frac{(1-2\overline{\alpha})\overline{\beta}\theta}{c}\right)=0 \end{aligned} \tag{28}$$

and the constraints in (27).

The letters A, B, C, D, E, F, G correspond to the multipliers for each of the constraints.

If $c<\hat{\beta}\theta$. No ideas are developed in spin-outs. Indeed, the principal can always offer $(\hat{\alpha}=c/\hat{\beta}\theta, \hat{w}=0), (\overline{\alpha}=c/\overline{\beta}\theta, \overline{w}=0)$, and $\underline{w}=\underline{\beta}\theta$. This menu of contracts leaves no rent to the agents with bad ideas and creates some value from the good ideas ($\overline{\beta}$ and $\hat{\beta}$) being developed in a spinoff. Therefore the employees will always be retained. For high values of $\hat{q}$ and/or $\overline{q}$ this may not be the optimal menu of contracts[25]. However the optimal contract could only improve things compared to the menu of contracts described above, so there will be no departures.

If $c>\hat{\beta}\theta$. I proceed in two steps.

First, I prove that if $\overline{\alpha}<\min\{c/\overline{\beta}\theta, 1\}$, then a contract $(\hat{\alpha}=1, \hat{w}=0)$ is not compatible with $\hat{IC}$. If $(\hat{\alpha}=1, \hat{w}=0)$, then $\hat{IC}$ becomes:

$$\hat{\beta}\theta\geq\overline{w}+\overline{\alpha}\hat{\beta}\theta\left(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c}\right) \tag{29}$$

The constraint is easiest to satisfy for the lowest possible $\overline{w}$, compatible with $\overline{IR}$, $\overline{w}=\overline{\beta}\theta-\overline{\alpha}\overline{\beta}\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)$. Therefore the constraint can be rewritten as follows:

$$\hat{\beta}\theta\geq\overline{\beta\theta}-\overline{\alpha}(\overline{\beta}-\hat{\beta})\theta\left(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c}\right)\Leftrightarrow 0\geq(\overline{\beta}-\hat{\beta})\theta(1-\overline{\alpha})\left(1-\frac{\overline{\alpha}\overline{\beta}\theta}{c}\right) \tag{30}$$

[25] The intuition is the same as in the case with two types.

It is immediate to see that the constraint does not hold if $\overline{\alpha} < \min\{c/\overline{\beta}\theta, 1\}$.

It follows that $\hat{\beta}$ will only be developed in spin-outs if $\overline{\alpha} = 1$ or if $\overline{\alpha} = c/\overline{\beta}\theta$.

Second, I now consider the cases where the ideas $\hat{\beta}$ are developed in spin-outs.

The employees with ideas $\hat{\beta}$ develop their ideas in spin-outs if the following set of constraints are binding: $\overline{IR}$, $\hat{IR}$, $\underline{IC}_1$, $\hat{IC}$, and $\underline{IR}$. From $\hat{IR}$, $\underline{IR}$, and $\underline{IC}_1$ holding with equality and $c > \hat{\beta}\theta$, it follows that $(\hat{\alpha} = 1, \hat{w} = 0)$. From $\overline{IR}$, $\hat{IR}$, and $\hat{IC}$ holding with equality, it follows that we should be in one of the following cases $\overline{\alpha} = c/\overline{\beta}\theta$ or $\overline{\alpha} = 1$.

First subcase: $\overline{\alpha} = c/\overline{\beta}\theta$, for this we need the following condition to hold $c < \overline{\beta}\theta$. The menu of contracts is: $(\overline{\alpha} = c/\overline{\beta}\theta, \overline{w} = 0)$, $(\hat{\alpha} = 1, \hat{w} = 0)$, and $\underline{w} = \underline{\beta}\theta$. In this case the ideas $\overline{\beta}$ are developed in spinoffs, the ideas $\hat{\beta}$ are developed in spin-outs, and the employees with $\underline{\beta}$ are retained in the core activity. In order to be in this case, the multipliers of the corresponding binding constraints need to be positive, which requires the following conditions to hold:

$$\begin{cases} \hat{q} \leq \dfrac{\underline{q}(\hat{\beta} - \underline{\beta})\theta(c - \hat{\beta}\theta)}{(\hat{\beta}\theta)^2} \\ \overline{q} \leq \dfrac{\hat{q}((\hat{\beta} - \underline{\beta})\theta(c - \hat{\beta}\theta) + (\hat{\beta}\theta)^2)}{(\hat{\beta} - \underline{\beta})\theta(c - \hat{\beta}\theta)} \dfrac{(\overline{\beta} - \hat{\beta})(\overline{\beta}\theta - c)}{\overline{\beta}c} \end{cases} \tag{31}$$

Second subcase: $\overline{\alpha} = 1$, for this we need the following condition to hold $c > \overline{\beta}\theta$. The menu of contracts is: $(\overline{\alpha} = 1, \overline{w} = 0)$, $(\hat{\alpha} = 1, \hat{w} = 0)$, and $\underline{w} = \underline{\beta}\theta$. In this case both $\overline{\beta}$ and $\hat{\beta}$ are developed in spin-outs, the employees with ideas $\underline{\beta}$ continue to work in the core activity. In order to be in this case, the multipliers of the corresponding binding constraints need to be positive, which requires the following conditions to hold:

$$\begin{cases} \hat{q} \leq \dfrac{\underline{q}(\hat{\beta} - \underline{\beta})\theta(c - \hat{\beta}\theta)}{(\hat{\beta}\theta)^2} \\ \overline{q} \leq \dfrac{\hat{q}((\hat{\beta} - \underline{\beta})\theta(c - \hat{\beta}\theta) + (\hat{\beta}\theta)^2)}{(\hat{\beta} - \underline{\beta})\theta(c - \hat{\beta}\theta)} \dfrac{(\overline{\beta} - \hat{\beta})\theta(c - \overline{\beta}\theta)}{(\overline{\beta}\theta)^2} \end{cases} \tag{32}$$

Finally, the last case to consider is: ideas $\overline{\beta}$ are developed in spin-outs, while $\hat{\beta}$ are developed in spin-offs. This happens if the following constraints hold with equality: $\overline{IR}$, $\hat{IR}$, $\underline{IC}_1$, and $\hat{IC}$. From $\overline{IR}$, $\hat{IR}$, and $\hat{IC}$, holding with equality it follows that we are in one of the following sub-cases $\overline{\alpha} = c/\overline{\beta}\theta$ or $\overline{\alpha} = 1$. The sub-case of interest is $\overline{\alpha} = 1$, which corresponds to $c > \overline{\beta}\theta$. The menu of contracts offered by the principal is:

$$\begin{cases} (\overline{\alpha} = 1, \overline{w} = 0) \\ (\hat{\alpha} = \dfrac{\underline{q}(\hat{\beta} - \underline{\beta})(c + \hat{\beta}\theta)}{\hat{\beta}\theta(\hat{q}\hat{\beta} + 2\underline{q}(\hat{\beta} - \underline{\beta}))}, \hat{w} = \hat{\beta}\theta - \hat{\alpha}\hat{\beta}\theta\left(1 + \dfrac{(1 - \hat{\alpha})\hat{\beta}\theta}{c}\right)) \\ \underline{w} = \hat{\beta}\theta - \hat{\alpha}(\hat{\beta} - \underline{\beta})\theta\left(1 + \dfrac{(1 - \hat{\alpha})\hat{\beta}\theta}{c}\right) \end{cases}$$

The conditions that need to be satisfied in order to be in this case are as follows:

$$\begin{cases} \hat{q} > \dfrac{\underline{q}(\hat{\beta} - \underline{\beta})\theta(c - \hat{\beta}\theta)}{(\hat{\beta}\theta)^2} \\ \overline{q} < \dfrac{(\overline{\beta} - \hat{\beta})(c - \overline{\beta}\theta)}{(\overline{\beta} - \hat{\beta})(c - \overline{\beta}\theta) + \overline{\beta}^2\theta} \end{cases} \tag{33}$$

Additional conditions would be added when we consider whether an employee should be allocated to the core or innovative activity. For low values of b the conditions for spin-out creations are as above.

A.7. Proof of Proposition 9

An agent who innovates outside the firm will explore any idea for which the following condition holds:

$$q \geq \frac{I - \underline{\beta}\theta}{(\overline{\beta} - \underline{\beta})\theta} \equiv q^o \tag{34}$$

An employee with a good idea leaves the firm and creates a spin-out if:

$$q < \min\{\frac{(c - \overline{\beta}\theta)(\overline{\beta} - \underline{\beta})}{(c - \overline{\beta}\theta)(\overline{\beta} - \underline{\beta}) + \overline{\beta}^2\theta}, \frac{(\overline{\beta} - \underline{\beta})\theta}{b(\theta - m) - \underline{\beta}\theta}\} \tag{35}$$

- If $q^o < \min\{\frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}, \frac{(\overline{\beta}-\underline{\beta})\theta}{b(\theta-m)-\underline{\beta}\theta}\}$

In this case, the expected payoff of an employee from exploring an opportunity that may be good with probability q^o is $q^o\overline{\beta}\theta + (1-q^o)\underline{\beta}\theta$. It is immediate to see that the employee does not have incentives to pass on opportunities with $q > q^o$ or to explore opportunities with $q < q^o$. This implies that the employee's decision rule is the same as for an outsider.

- If $q^o \geq \frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}$, then we shall consider two sub-cases.

(i) If $\frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta} \leq q^o \leq \frac{\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}{b(\theta-m)-(\overline{\beta}\theta+(1-\overline{\alpha}^2)(\overline{\beta}\theta)^2/2c)+\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}$

In this case, for $q = q^o$ the good ideas are developed in a spinoff, which implies that the menu of contracts offered to the employees is as characterized in Proposition 1. The expected payoff of an employee who decides to explore a new opportunity that will turn into a good idea with probability q^o is:

$$q^o\overline{\beta}\theta + (1-q^o)\underline{w}, \tag{36}$$

where $\underline{w} = \overline{\beta}\theta - \overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c}) > \underline{\beta}\theta$. This implies that, $q^o\overline{\beta}\theta + (1-q^o)\underline{w} > I$, it follows that the employee has incentives to explore opportunities with $q < q^o$.

The employee explores any idea with q such that:

$$q \geq \max\{\frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}, \frac{I-\underline{w}}{\overline{\beta}\theta-\underline{w}}\} \tag{37}$$

(ii) If $q^o \geq \frac{\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}{b(\theta-m)-(\overline{\beta}\theta+(1-\overline{\alpha}^2)(\overline{\beta}\theta)^2/2c)+\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}$

In this case, for $q = q^o$ the employees with good ideas are allocated to the core activity, the principal offers the same wage $\overline{\beta}\theta$ to all employees. The expected payoff of an employee who decides to explore a new opportunity with probability q^o to be good is:

$$q^o\overline{\beta}\theta + (1-q^o)\overline{\beta}\theta = \overline{\beta}\theta \tag{38}$$

It is in an employee's interest to explore all opportunities with

$$q \geq \frac{\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}{b(\theta-m)-(\overline{\beta}\theta+(1-\overline{\alpha}^2)(\overline{\beta}\theta)^2/2c)+\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}$$

It is in the employee's interest to explore any idea for which the following inequality applies:

$$q \geq \max\{\frac{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})}{(c-\overline{\beta}\theta)(\overline{\beta}-\underline{\beta})+\overline{\beta}^2\theta}, \min\{\frac{I-\underline{w}}{\overline{\beta}\theta-\underline{w}}, \frac{\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+(1-\overline{\alpha})\overline{\beta}\theta/c)}{b(\theta-m)-(\overline{\beta}\theta+(1-\overline{\alpha}^2)(\overline{\beta}\theta)^2/2c)+\overline{\alpha}(\overline{\beta}-\underline{\beta})\theta(1+\frac{(1-\overline{\alpha})\overline{\beta}\theta}{c})}\}\} \tag{39}$$

A.8. Incentives to come up with a good idea

Let us consider that by choosing the amount of effort e an agent decides to put into an innovative activity he may affect the probability of his idea being good. I assume that an idea will be good ($\overline{\beta}$) with probability e and bad ($\underline{\beta}$) with probability $1-e$. The cost of effort is $c(e)$, with $c'(e) > 0$, $c''(e) > 0$, $c'(0) = 0$ and $c'(1) \to +\infty$. Effort is not contractible.

The incentives of an outsider are given by[26]:

$$\theta(\overline{\beta}-\underline{\beta}) = c'(e) \tag{40}$$

The incentives of an employee are given by:

$$\max_e R^{in} = e\overline{\beta}\theta + (1-e)\underline{w} - c(e) \tag{41}$$

[26] This is the first order condition of an agent who maximizes $\max_e R^{out} = e\overline{\beta}\theta + (1-e)\underline{\beta}\theta - c(e)$

The first order condition writes:

$$\overline{\beta}\theta - \underline{w} = c'(e) \tag{42}$$

Since $c''(e) > 0$, in all cases where $\underline{w} > \underline{\beta}\theta$, it is in the employee's interest to exert less effort than an outsider.

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